

## CLAIMS

1. A device for clamping a relatively movable rod comprising

- a body member,
- 5     • a bushing carried by said body member and provided with
  - a central bore defining an inner surface through which the rod is coaxially and slidingly received, and
  - a center section radially deflective between
    - an inner position engaging and clamping the rod against
    - 10                     movement relative to the body member and
    - an outer position releasing the rod for relative movement,
- a hydraulic system for moving said center section between its said outer and inner positions comprising
  - a liquid receiving expandable cell contiguous with said center section
  - 15     • at least one cylinder bore,
  - passage means between said cell and said cylinder bore,
  - a piston pin movable in said cylinder bore, and
  - a substantially incompressible hydraulic liquid filling said hydraulic system,
- 20     • said piston pin being movable in said cylinder bore
  - toward an inner position generating and transmitting pressure through said hydraulic liquid to expand said cell to move said center section to its inner position to clamp the rod, and
  - to an outer position relieving pressure from and permitting contraction
  - 25                     of said cell and movement of said center section to its outer position to release the rod for relative movement,
- an actuating piston engaging said piston pin and moving therewith between inner and outer positions,
- means biasing said actuating piston and said piston pin toward their inner
- 30                     position, and

- means for applying pressure against said actuating piston to move said actuating piston and said piston pin in contravention to said biasing means to their outward position to release the rod for movement,
- said biasing means moving said actuating piston and said piston pin toward their inner position to move said center section to its inner position to clamp the rod against relative movement in the event of a significant reduction of pressure against said actuating piston.

2. A device according to claim 1 characterized by

- said hydraulic system comprising
  - more than one cylinder bore,
  - a piston pin movable in each of said cylinder bores,
  - passage means between said cell and said cylinder bores, and
- said actuating piston being engaged and movable simultaneously with each of said piston pins.

3. A device according to claim 2 characterized by

- said hydraulic system having three cylinder bores
- a piston pin movable in each of said three cylinder bores,
- passage means between said cell and said three cylinder bores, and
- said actuating piston being engaged with and movable simultaneously with said three piston pins.

4. A device according to claim 3 characterized by

- said body member having
  - a generally circular base portion,
  - a circular sleeve extending outwardly from said base portion and provided with a centrally disposed cylindrical aperture extending through the device,
- said bushing being axially aligned with and mounted within said centrally

disposed cylindrical aperture,

- said three cylinder bores being circumferentially spaced in said base portion radially around said sleeve,
- said actuating piston being
  - generally ring shaped,
  - provided with an inner periphery sized to slide over the outer periphery of said sleeve,
  - provided with an inner end
    - engaged with said piston pins and
    - against which pressure is applied by said pressure means for moving said actuating piston and said piston pins to their outward position to release the rod for movement.

5. A device according to claim 4 characterized by

- a liquid impervious radially resilient sleeve covering the outer periphery of said center section,
- the outer surface of said resilient sleeve being spaced from and forming with the inner surface of said aperture said annular space,
- seal rings positioned proximate the ends of said bushing and sealingly engaging the inner surface of said aperture,
- said annular space between the seal rings comprising said liquid receiving expandable cell.

6. A device according to claim 5 characterized by

- said center section being
  - formed of a wear resistant material and
  - slit into longitudinally disposed segments capable of radially expanding to decrease the outside diameter of said center section in response to the expansion of said cell.

7. A device according to claim 6 characterized by said device having

- a generally cylindrical intermediate section positioned in axial alignment with and affixed to said body member,
- said intermediate section providing an inner cylindrical wall concentric with said sleeve and sized to slidably receive the outer periphery of said ring shaped actuating piston, and
- a generally circular cap section axially aligned with and affixed to and closing the outer end of said intermediate section,
- said cap section having a centrally disposed opening through which the rod projects.

8. A device according to claim 7 characterized by

- the outer periphery of said sleeve and the inner periphery of said intermediate body section defining a ring shaped space in which said actuating piston is slidably received for sliding movement between
  - an outer position abutting the interior surface of said cap section and
  - an inner position proximate the outwardly facing surface of said base portion of said body member,
- said piston pins being movable between their said inner and outer positions in response to movement of said actuating piston between its said inner and outer positions.

9. A device according to claim 8 characterized by

- at least one housing unit between said cap section and said actuating piston, and
- a compression spring disposed in said housing unit under tension whereby said actuating piston is continuously biased by said spring toward its inner position.

10. A device according to claim 9 characterized by

- at least three housing units provided between said cap section and said actuating piston, each said housing unit comprising axially aligned circular recesses located in the interior surface of said cap section and the outer surface of said actuating piston,
- a compression spring disposed in each of said housing units,
- said springs each having essentially the same reactive force to provide substantially even pressure circumferentially around said actuating piston.

11. A device according to claim 10 characterized by

- a pressure source,
- a pressure port provided in said intermediate body section opening into said ring shaped space proximate the outwardly facing surface of said body portion,
- said pressure source being operable to inject fluid into said ring shaped space through said pressure port and between the inner surface of said actuating piston and the outwardly facing surface of said base portion under pressure sufficient to move said actuating piston outwardly in contravention to the pressure of said compression springs.

12. A device according to claim 4 characterized by said bushing having

- a first end flange sized to fit snugly within said aperture and
- a second end flange seated on and secured to the outer end of said sleeve whereby said center section will clamp the rod against both axial and rotative movement.

13. A device according to claim 1 characterized by said central bore of said bushing being non-circular in cross section.

14. A device according to claim 13 characterized by said central bore of said bushing being substantially rectangular in cross section.

15. A device according to claim 13 characterized by said central bore of said bushing being substantially octagonal in cross section

5 16. A device according to claim 1 wherein said rod is fixed and said Device is selectively movable relative to and clampable against movement on said rod.

17. A device according to claim 1 wherein said device is fixed to a power cylinder having a rod axially aligned with and movable through the device, said rod being

- 10
- movable relative to the power cylinder and said device upon the simultaneous injection of a fluid pressure into the cylinder and said device, and
  - clamped against movement upon the simultaneous release of fluid pressure from the cylinder and said device.

15

18. A device for clamping a relatively movable rod comprising

- a body member having
    - a generally circular base portion,
    - a circular sleeve extending outwardly from said base portion and
- 20 provided with a centrally disposed cylindrical aperture extending through the device,
- a bushing disposed within said cylindrical aperture and provided with
    - a central bore defining an inner surface through which the rod is coaxially and slidingly received,
- 25
- a center section radially deflective between
    - an inner position engaging and clamping the rod against movement relative to the body member and
    - an outer position releasing the rod for relative movement,
  - a liquid impervious radially resilient sleeve covering the outer
- 30 periphery of said center section,

- the outer surface of said resilient sleeve being spaced from and forming with the inner surface of said cylindrical aperture an annular space,
  - seal rings positioned proximate the ends of said bushing and sealingly engaging the inner surface of said cylindrical aperture,
  - said annular space between the seal rings comprising a liquid receiving expandable cell,
- a hydraulic system for moving said center section between its said outer and inner positions comprising
  - said liquid receiving expandable cell,
  - three cylinder bores circumferentially spaced in said base portion radially around said sleeve,
  - passage means between said cell and each of said cylinder bores,
  - a piston pin movable in each of said cylinder bores, and
  - a substantially incompressible hydraulic liquid filling said hydraulic system,
  - said piston pins being movable simultaneously in said cylinder bores
    - toward an inner position generating and transmitting pressure through said hydraulic liquid to expand said cell to move said center section to its inner position to clamp the rod, and
    - to an outer position relieving pressure from and permitting contraction of said cell and movement of said center section to its outer position to release the rod for relative movement,
- an actuating piston engaging said piston pins and moving therewith between inner and outer positions, said actuating piston being
  - generally ring shaped,
  - provided with an inner periphery sized to slide over the outer periphery of said sleeve, and
  - provided with an inner end engaged with said piston pins,
- a generally cylindrical intermediate body section positioned in axial alignment

with and affixed to said body member,

- said intermediate body section providing an inner cylindrical wall concentric with said sleeve and sized to slidingly receive the outer periphery of said ring shaped actuating piston,
- 5     • a generally circular cap section axially aligned with and affixed to and closing the outer end of said intermediate body section,
  - said cap section having a centrally disposed opening through which the rod projects,
- 10    • the outer periphery of said sleeve and the inner periphery of said intermediate body section defining a ring shaped space in which said actuating piston is received for sliding movement between
  - an outer position abutting the interior surface of said cap section and
  - an inner position abutting the outwardly facing surface of said base portion of said body member,
- 15    • said piston pins being movable between their said inner and outer positions in response to movement of said actuating piston between its said inner and outer positions,
- means biasing said actuating piston and said piston pins toward their inner position, said biasing means comprising
  - 20       • at least three housing units provided between said cap section and said actuating piston, each said housing unit comprising an axially aligned circular recesses located in the interior surface of said cap section and the outer surface of said actuating piston,
  - a compression spring disposed in each of said housing units,
  - 25       • said springs each having essentially the same reactive force to provide substantially even pressure circumferentially around said actuating piston, and
- means for applying pressure against said actuating piston to move said actuating piston and said piston pins in contravention to said biasing means to their outward position to release the rod for movement, said pressure
- 30



means comprising

- a pressure source,
- a pressure port provided in said intermediate body section opening into said ring shaped space proximate the outwardly facing surface of said body portion,
- said pressure source being operable to inject fluid into said ring shaped space through said pressure port and between the inner surface of said actuating piston and the outwardly facing surface of said base portion under pressure sufficient to move said actuating piston outwardly in contravention to the pressure of said compression springs.

19. A device according to claim 4 characterized by

- said bushing having end flanges of substantially equal outside diameter snugly received within said circular aperture, and
- means for restraining said bushing against axial movement within said circular aperture.

20. A device according to claim 19 wherein said restraining means comprises a ring member mounted in the inner wall of said circular aperture contiguous with each end of said bushing.

21. A device for clamping a relatively movable rod comprising

- a clamp unit having a body member with a centrally disposed aperture,
- a bushing mounted within said aperture and provided with
  - a central bore defining an inner surface through which the rod is coaxially and slidingly received, and
  - a center section radially deflective between
    - an inner position engaging and clamping the rod against movement relative to the body member and

- an outer position releasing the rod for relative movement,
- the outer surface of said being spaced from and forming with the inner surface of said aperture an annular space,
- seal rings positioned proximate the ends of said bushing and sealingly engaging the inner surface of said aperture,
- said annular space between the seal rings comprising a liquid receiving expandable cell,
- a pressure unit remote from said clamp unit and comprising
  - a rearward section having
    - a generally circular base portion,
    - a circular sleeve extending outwardly from said base portion,
  - a generally cylindrical intermediate body section positioned in axial alignment with and affixed to said body member,
    - said intermediate body section providing an inner cylindrical wall concentric with said sleeve and forming therewith a ring shaped space,
  - a generally circular cap section axially aligned with and affixed to and closing the outer end of said intermediate body section,
  - a hydraulic system for moving said center section between its said outer and inner positions comprising
    - said cell,
    - a substantially incompressible hydraulic liquid filling said hydraulic system,
    - three cylinder bores circumferentially spaced in said base portion radially around said sleeve,
    - passage means comprising a high pressure line between said cell and said cylinder bores,
    - a piston pin movable in each of said cylinder bores
      - toward an inner position generating and transmitting pressure through said hydraulic liquid to expand said cell

to move said center section to its inner position to clamp the rod, and

- to an outer position relieving pressure from and permitting contraction of said cell and movement of said center section to its outer position to release the rod for relative movement,

- a ring shaped actuating piston slidably disposed in said ring shaped space and engaging said piston pins and moving therewith between inner and outer positions,

- means biasing said actuating piston and said piston pins toward their inner position, and

- means for applying pressure against said actuating piston to move said actuating piston and said piston pins in contravention to said biasing means to their outward position to release the rod for movement,

- said biasing means moving said actuating piston and said piston pins toward their inner position to move said center section to its inner position to clamp the rod against relative movement in the event of a significant reduction of pressure against said actuating piston.

22. A device according to claim 21 characterized by said high pressure line comprising a flexible hose.